

Chapter 10

Skill and Foreign Firm Premium: The Role of Technology Gap and Labor Cost

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ABSTRACT

In this chapter, the authors construct a model that allows for joint discussion of foreign firm and skill premium in wages, and their evolution upon increased foreign firm activities. They allow for (1) dynamic interaction between the domestic and foreign firms in the labor market, via a two-sided search model, (2) technology differentials between domestic and foreign firms, and (3) varying cost of doing business between domestic and foreign firms. Analytical and numerical results point to the importance of modeling all three features. Both the level and the changes in the relative wages depend on the productivity differential (technology gap) and the job creation costs.

1. INTRODUCTION

Multinational Enterprises (MNEs) have become one of the key players in extensively integrated economies since they have gained an important ground in transmitting new technologies, managerial techniques, skills, and capital across borders¹. In this context, to benefit from new technology, knowledge and market opportunities, domestic policy makers (as well as firms) encourage foreign

firms to establish local subsidiaries². Alongside their effect on local firm productivity through technology transfers, investments by foreign firms have important implications for local labor market conditions. According to the World Investment Report (UNCTAD, 2007) around 3% of worldwide employees work for foreign affiliates of MNEs, representing a threefold increase from 1990 to 2006 in the absolute number of these workers. The same report further emphasizes the importance of understanding the impact of increased foreign firm presence which is evident in the increasing

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employment opportunities by foreign firms, where the share of employment in foreign affiliates in total employment ranges from around 1% in Japan to as high as 51% in Ireland³.

The effects of increased foreign firm presence is not limited to employment effects in the host country labor market, in fact two stylized facts stand out in the data regarding the wage effects of MNE activities. First, a change in the structure of domestic production upon the entry of foreign firms alters the wage gap between skilled and unskilled workers (see Gopinath & Chen, 2003; Markusen & Venables, 1997, among others). Second, foreign firms tend to pay different wages than domestic firms (see Aitken, et al., 1996; Feenstra & Hanson, 1996; Lipsey & Sjöholm, 2004, among others). The literature is dominated by theoretical studies that explore the first issue regarding the relative wages between the skilled and unskilled labor, i.e. the *skill premium*, and by empirical studies exploring the second issue regarding the relative wages paid by foreign and domestic firms, i.e. the *foreign firm premium*.

The evidence detailed in these studies regarding the evolution of both the skill and foreign firm premium is quite mixed across host countries. Regarding the skill premium's evolution evidence suggests an upward move for several host countries, but with ample countries experiencing the exact opposite trend. Looking into the wage effects of international economic integration, studies have shown mixed evidence regarding the issue⁴. A similar mixed pattern is suggested in studies of the relative wages paid by foreign and domestic firms. While studies by Driffield and Girma (2003), Conyon *et al.* (2002), Martins (2004), and Aitken *et al.* (1996) document higher wages being paid by foreign firms, Lipsey and Sjöholm (2004), Almeida (2007), Barry *et al.* (2005), and Girma *et al.* (2001) note that foreign firms do not always pay more than local firms. None of the existing studies look into the *joint* determination of the skill and foreign firm premia. This chapter fills this gap in the literature, building

a framework that explains the two observations synchronously and allowing for a detailed parametric identification of the absolute and relative wage implications of increased MNE activities in the host country. The below framework furthermore allows investigation of employment effects of MNE activities alongside their wage effects, which enriches the analysis.

Another important issue, alongside the lack of simultaneous discussion of the two-wage premia, is the mixed empirical and theoretical evidence regarding the evolution of both skill and foreign firm premia which raises the question of what factors contribute to this nonlinearity. The common theme in the theoretical models studying the skill premia effects of increased MNE activities is that the effects of Foreign Direct Investment (FDI) on relative wages in the source and the host countries depends on the characteristics of the investment and the conditions in the invested environment⁵. Studies on the second empirical observation, regarding the differential wages across domestic and foreign firms, resonates a similar *absorptive capacity*⁶ story with differing foreign firm premium across developing countries. Such evidence can be interpreted as suggesting that the foreign firm premia also differs across host countries depending on the absorptive capacities, either of the local market or of the firm. The important message to be taken from this strand of the literature is that the *local conditions* as well as the *investment characteristics*, which we will lump in the term *absorptive capacities* matters in the determination of the wage effects of increased foreign presence⁷.

The below framework incorporates two important dimensions of these absorptive capacities. First, taking cue from the existing studies that show the important role played by the technology gap in explaining wage effects of MNE activities the model includes productivity differential between domestic and foreign firms (see Glass & Saggi, 2002; Sayek & Sener, 2006). Inclusion of the technology gap across firms in the model captures

the absorptive capacities that are due to the firm characteristics. As MNEs are considered to be an important mechanism for technology diffusion to local markets, an impressive body of empirical evidence has developed around the spillover effects of MNEs to identify the potential channels of spillovers. Vertical spillovers, which are created by the backward and forward linkages, take place between foreign affiliates and local firms (Alfaro & Rodriguez-Clare, 2004; Lall, 1995; Rodriguez-Clare, 1996; Aitken & Harrison, 1999; Görg & Greenaway, 2004; Javorcik, 2004). Horizontal spillovers arise as a result of imitation, demonstration effects, reverse engineering or competitive pressure exerted by foreign firms (Mansfield & Romeo, 1980; Blömmstrom, 1986).

As noted above absorptive capacities can further differ across countries due to differences in the business/investment environment. One such difference is due to differential administrative costs incurred across local and foreign firms, and across countries. Morisset and Neso (2002), in a novel data collection effort identify such a variation in administrative costs. For example, they find that in India the foreign firms face 12 times larger monetary administrative barriers in doing business than local firms do. The same ratio is found to vary from 8 in Turkey, to 3 in Chile and 2 in Argentina. Such discrepancy, we find below, plays a significant role in explaining the differential skill and foreign firm premium observed across countries. Rudimentary evidence is also available from a comparison of the skill premium between Chile and Argentina, for which Morisset and Neso (2002) find a 50% differential in the relative cost of doing business between foreign and local firms. The Inter-American Development Bank's (IDB) 2004 report on the Latin American region reports that the skill premium in Argentina was much lower than that observed in Chile. In short, the below framework suggests that there could be a link between these administrative costs, the extent of MNE activities and relative wages⁸.

Such differential cost of doing business across local and foreign firms is also evident in the summary data from the Investment Climate Assessment (ICA) reports of the World Bank. Summary indicators from the ICA suggests that the "share of firms that thought labor regulations were more than moderately investment hindering" differs extensively across multinational and local firms in host countries. For example, in Brazil while 47 percent of foreign firms consider that labor regulations in Brazil hinder investment the same share increases to 57 percent when asked to local firms. The same distribution differs drastically in the Philippines, where a larger share of foreign firms (61 percent) views labor market regulations as a hindrance to investment than local firms (22 percent)⁹. Such variation in labor market regulation perceptions across firms and countries, as well as more general administrative cost measures suggests that these costs should also be included among the usual suspects of *absorptive capacities*. As such the below framework includes costs of doing business in the local labor market that differ between local and foreign firms¹⁰.

The last piece of evidence on the differential labor market costs between local and foreign firms suggests that using a search model framework would allow inclusion of such frictions in the model easily while studying the wage and employment dynamics of increased MNE activities. As such, below the question of how the skill and foreign firm premia are affected from increased MNE activity is studied by means of a search model. Search and matching models have a crucial role in explaining the labor market transitions, providing a very suitable framework to study the labor market fluctuations following the entry of foreign firms. The important role played by job creation costs in allowing for the search models to capture the fluctuations in the mass of vacancies, wages, and unemployment rates are discussed in detail in several studies including Mortensen and Pissarides (1994), Faggio and Konings (2003), Shimer (2003), Vanhala (2004), and Carlson *et*

al. (2006), among others. These differential job creation costs are expected to have implications on the job creation patterns across domestic and foreign firms.

In the following analysis the basic structure of Gautier (2002), Albrecht and Vroman (2002) and Dolado *et al.* (2003) is adopted to study the wage premia upon increased MNE activity. While Gautier (2002) has good and bad jobs the below framework will have domestic firm and foreign firm jobs. Furthermore, our framework is parallel to this work in that there is heterogeneity across workers and on-the-job search is allowed for. In the below framework, increased heterogeneity of posted vacancies due to the entry of foreign firms, encourages on-the-job-search. An important feature of the below model is that it allows for a two-sided search, where workers (both skilled and unskilled) that are already employed by local firms can perform on-the-job search that allows them to move to foreign firms and vice versa. Inclusion of this two-sided search feature in the model is justified empirically. Empirical evidence on the mobility of workers in the FDI literature suggests that foreign firms try to attract experienced skilled and unskilled workers performing local jobs to compensate for their lower level of information on the host market. While foreign firms will try to allude workers from local firms to compensate for information frictions, local firms will try to allude workers from the foreign firms to benefit from technological spillovers¹¹. This basic structure is extended to allow for two-sided search by all types of labor. In summary, the below analysis contributes to studying the skill and foreign firm premium implications of international factor movements by allowing for the empirically well-justified two-sided search¹².

In summary, the goal of the following analysis is to study two questions: whether or not foreign firms always pay more than local firms do and how the skill and foreign firm premia evolve upon increased foreign firm activity in the local economy. In constructing the model, the three

important issues identified above are accounted for. First and foremost, the model allows for the joint determination of the skill and foreign firm premium and adds to the existing analysis in the literature. Second, the model incorporates absorptive capacities that are due to firm-characteristics (i.e. the technology gap) and the local economy characteristics (i.e. differences in costs of doing across local and foreign firms, which differ across countries). The results point to the important role played by these differential costs in the evolution of the skill and foreign firm premia as well as the level of the foreign firm premium. Third and finally, the model allows bi-directional movement of both skilled and unskilled labor between local and foreign firms by use of a search model with two-sided search features.

The main features of the below model can be summarized as follows: there are a number of unskilled and skilled job seekers, who are either unemployed or employed. Vacancies are posted by local and foreign firms looking for skilled and unskilled workers. However, job creation through vacancy posting is not a costless procedure, capturing the cost of doing business in the host country. The structure of job creation costs, which differs between local and foreign firms, plays a major role in the extent of vacancy creation by the foreign firms and is crucial in the discussion of the effects of MNEs on the labor market. Job seekers and firms meet according to the matching function. When a worker and firm meet, the wage is set in accordance with the Nash bargaining approach. In this matching process, skilled and unskilled workers (both in the foreign and local firms) can engage in on-the-job-search¹³. By allowing on-the-job-search, it is possible that skilled and unskilled workers in local (foreign) firms switch into foreign (local) firms. In addition, different productivities across firms and workers are allowed for. The analytical results provide two very important results. First, an increase in the vacancies posted by local (foreign) firms will increase the wages paid by local (foreign) firms to

both skilled and unskilled worker, while reducing the wages paid by foreign (local) firms to both skilled and unskilled workers. Second, the level of premium paid to working at a foreign firm rather than a domestic firm can be positive or negative, and this as well as the absolute level depends on the technology gap between the local and foreign firms and the cost of doing business for both local and foreign firms.

Due to nonlinearities in the equilibrium wage equations, the discussion of relative wages is undertaken numerically. Numerical solutions suggest that, under the baseline choice of parameters, a higher share of foreign firm presence reduces the skill premium and increases the foreign firm premium in the local economy. The solutions further point to the important differences in these results when the cost of vacancy creation is altered for both local and foreign firms, versus when the playing levels is changed to favor the foreign firm only. In summary, within this framework we can conclude that wage dispersion across foreign and local firms stems from not only productivity differentials but also from the extent of job creation; and the same factors influence the direction and magnitude of the wage effects of increased foreign presence.

Accordingly, the chapter is organized as follows: section 2 presents the main characteristics of the model, section 3 provides an equilibrium analysis and displays wages, and is followed by a numerical example in section 4. Section 5 summarizes and concludes.

2. THE MODEL

The basis of the set-up is a standard labor search model, enriched by allowing for on-the-job search. The following model adds two important features to the standard framework: on-the-job search, which is possible in both directions between domestic and foreign firms, and differential costs of job posting between domestic and foreign firms.

Both assumptions are well justified by empirical evidence discussed in the above section 1.

Better matching opportunities arise to workers through on-the-job-search. Already employed workers either search while already in a job due to deterioration of their job satisfaction (or an improvement in outside options) or because of the quality of their match with the firm turns out to be unsatisfactory (Krause & Lubik, 2006). While the on-the-job search feature is justified from the workers aspect, it is also a necessary feature in a model of MNE activity. In summary, as noted above, the basic structure of the below model follows Gautier (2002), Albrecht and Vroman (2002), and Dolado *et al.* (2003) with extensions of two sided on-the-job search opportunities.

Another important feature of the below model is the inclusion of differential “costs of doing business” across MNEs and local firms. The costs of doing business will be captured by the cost of posting and filling up job vacancies. Representing these general costs reflective of the overall investment climate is most suitable with those related to the job market in a labor search model framework.

Foreign firms create various job opportunities depending on their activities in the host country¹⁴. To compete and prosper, both foreign and local firms are expected to restructure their activities, facilities, and skills and tailor them to the changing technologies. In this context, both firms offer various job opportunities for skilled and unskilled workers while restructuring their activities. Studies show that foreign-owned enterprises are the more dynamic ones in terms of job creation/destruction. This dynamism comes from their ability to fire unproductive workers and hire new ones, destroy inefficient jobs and create efficient ones, close down plants and establish new ones given less binding political and social constraints (Faggio & Konings, 2003). Thus, they are able to undertake the fundamental changes necessary for restructuring. The below model assumes differential costs across foreign and domestic firms

in such restructuring with implications on the endogenously determined job creation/destruction rates of both firms, refraining from exogenously enforcing different rates of job creation by foreign and local firms.

The costs of job creation are justified empirically and theoretically. Restructuring in the labor market by means of job creation is not a costless procedure¹⁵. Firms must create a vacancy to hire new workers. Particularly, vacancies are known as a form of investment and firms must incur a cost to reach job seekers and to acquire information on the characteristics of applicants. Due to the informational frictions in the labor market, firms experience difficulties in matching with suitable job seekers. To overcome the informational hurdle and to make the vacancy visible, firms spread information about the characteristics of their vacancies by using various recruitment methods such as public employment services, advertisement and/or private employment agencies (Russo, et al., 2005). The firms not only incur costs at the initial vacancy posting stage but incur further costs at all stages of recruiting such as the cost of posting, advertising and screening pertaining to all vacancies and the cost of initial training (Fonseca, et al., 2001; Hammermesh, 1993; Russo, et al., 2005). Actually, firms use different search strategies and different recruitment methods, thus, they follow different job creation policies depending on the cost structures. In this regard, when investing in a new host economy by means of new job opportunities, foreign firms need to spend some effort in order to locate better matching opportunities, furthermore they have to incur costs associated with operating in an unfamiliar foreign environment (Fosfuri, et al., 2001). Given the important and differential role of job creation costs across domestic and foreign firms the below model incorporates such costs as crucial ingredients in the set-up. The basic ingredients of the framework are discussed in the following sub-section 2.1, followed by a discussion of the matching between employees and employers in

sub-section 2.2., and finally the bargaining and wages are discussed in sub-section 2.3 to complete the depiction of the framework.

2.1. Basic Assumptions

Consider a continuous time model in which workers are infinitely lived and risk neutral. The measure of workers is normalized to one. We assume that the distribution of skills across workers is exogenous: $\mu \in (0,1)$ share of the workers are unskilled (ι) while the remaining fraction, $1 - \mu$, are skilled (s). There are two types of jobs: (L) and foreign jobs (F). These jobs can be performed by both types of workers. Let y_j^i denote the flow output of a job of type $i (= L, F)$ that is filled by a worker of type $j (= \iota, s)$. Assumptions on production technology can be summarized as follows:

$$y_s^F > y_s^L \text{ and } y_\iota^F > y_\iota^L$$

That is, the flow output that would result from a match between a skilled worker and a foreign firm is higher than the flow output from a match between a skilled worker and a local firm. A similar situation applies to unskilled workers. This follows the empirical evidence that foreign firms are more productive than local firms, which is a widely accepted fact in the literature (see Dunning, 1993; Caves, 1996; Conyon, et al., 2002, among many others). Assuming foreign firms act as a source of new technology, production process, managerial technique or a new organizational form (Fosfuri, et al., 2001), workers are more productive in foreign firms. This discrepancy in productivities of similar workers across different firms is what we label as the technology gap. Job destruction is exogenous at rate δ . Whenever a job is destroyed the worker becomes unemployed and the job becomes vacant. During unemployment, workers receive an unemployment benefit of b .

As noted above, the firms incur costs associated with job creation. These costs include both those related to the initial recruitment activity and the follow-up costs associated with continuous training opportunities and necessities presented to the skilled and unskilled workers. While both domestic and foreign firms are expected to incur these types of costs, evidence suggests that these costs differ across the two types of firms. The information frictions present in the host country are expected to be higher for the foreign firms than the domestic firms due to their lack of familiarity with the business environment (see for example Fosfuri, et al., 2001). Evidence further suggests that MNEs offer more training to workers than the domestic firms do. The World Bank ICAs suggest that, for example, in Brazil while 94 percent of foreign firms reported they offer formal (beyond “on the job”) training to their permanent employees 66 percent of local firms did so¹⁶. Therefore, it is reasonable to base the below model on the premise that the cost of job generation is higher for foreign firms than that of the local firms. Denoting the costs of job creation in the local and foreign firms as c_L and c_F , respectively, we assume $c_F > c_L$, where F stands for foreign firms and L stands for local firms¹⁷. Finally, the model allows for two-sided search, where workers already employed are allowed to conduct on-the-job search in both domestic and foreign firms and are allowed to move in any direction between the two types of firms.

2.2. Matching

Suppose that there are vacancies posted by local and foreign firms looking for skilled (s) and unskilled (u) workers. Workers and vacancies meet according to the matching function $q_u(\cdot)$ and $q_s(\cdot)$, which is increasing in the relevant amount of job seekers and vacancies. Specifically, the total number of matches between a

worker and a firm is determined by the standard Cobb-Douglas matching function:

$$q_u \left[(v_L + v_F), (u_l + e_{l,L} + e_{l,F}) \right] \\ = (u_l + e_{l,L} + e_{l,F})^\alpha (v_L + v_F)^{1-\alpha}$$

$$q_s \left[(v_L + v_F), (u_s + e_{s,L} + e_{s,F}) \right] \\ = (u_s + e_{s,L} + e_{s,F})^\alpha (v_L + v_F)^{1-\alpha}$$

where v_L is the mass of local vacancies, v_F is the mass of foreign vacancies, u_l is the mass of unemployed unskilled workers, u_s is the mass of unemployed skilled workers, $e_{l,L}$ and $e_{s,L}$ stand for the number of unskilled and skilled workers performing local jobs, $e_{l,F}$ and $e_{s,F}$ are number of unskilled and skilled workers in the foreign firm; and α corresponds to the elasticity of matching with respect to the mass of job seekers. The number of unemployed workers in the host country is denoted by u which is the sum of u_l and u_s .

The labor market tightness for unskilled and skilled workers are represented by

$$\theta_l = \frac{v_L + v_F}{u_l + e_{l,L} + e_{l,F}} \text{ and } \theta_s = \frac{v_L + v_F}{u_s + e_{s,L} + e_{s,F}},$$

which are the ratio of total job vacancies to total unskilled and skilled job seekers, respectively. In tight (slack) labor markets the pool of job seekers shrinks (enlarges) and the degree of competition among firms intensifies (lessens) (see Russo, et al., 2005, among others). In summary, an increase in θ_l or θ_s implies increased job market tightness; which is from the perspective of the employer. Accordingly, the rate at which firms meet an unskilled job seeker is equal to

$$q_u(\theta_l) = q_u \left(1, \frac{1}{\theta_l} \right) = \theta_l^{-\alpha}$$

and the matching rate at which firms meet a skilled worker is equal to $q_s(\theta_s) = q_s\left(1, \frac{1}{\theta_s}\right) = \theta_s^{-\alpha}$ while the rate at which unskilled and skilled workers meet a vacant job is equal to $\theta_l \cdot q_l(\theta_l) = \theta_l^{1-\alpha}$ and $\theta_s \cdot q_s(\theta_s) = \theta_s^{1-\alpha}$, respectively. Given the properties of the matching function, the matching rate of firms $q_l(\theta_l)$ and $q_s(\theta_s)$ is decreasing in θ_l and θ_s , that is, $q'_l(\theta_l) \leq 0$ and $q'_s(\theta_s) \leq 0$, while the matching rate of workers $\theta_l \cdot q_l(\theta_l)$ and $\theta_s \cdot q_s(\theta_s)$ is increasing in θ_l and θ_s , respectively. In tight labor markets, the matching rate of firms decreases while the matching rate of workers increases. It is also convenient to define a variable $\eta\left(\eta = \frac{v_L}{v_L + v_F}\right)$, which represents the share of local vacancies in total vacancies.

The labor market mobility acts as a movement from unemployment to employment, from job to job and back to unemployment. That is, unemployed unskilled and skilled workers move into local and foreign firms and workers in local and foreign firms may fall into the unemployment pool and the workers in the local (foreign) firms may switch into the foreign (local) firms. The steady state conditions require that the flows into and out of unemployment for both types of workers be equal. Accordingly, the steady state conditions are given as follows:

$$\theta_l^{1-\alpha} u_l = \delta(\mu - u_l) \quad (1)$$

$$\theta_s^{1-\alpha} u_s = \delta(1 - \mu - u_s) \quad (2)$$

where Equation (1) reflects the flow conditions for the unskilled labor. That is, a flow $\theta_l^{1-\alpha}$ of unskilled unemployed workers find employment in firms, which equals to the flow of unskilled workers into unemployment due to the job destruction, $\delta(\mu - u_l)$. Similarly, Equation (2) is the

flow condition for the skilled workers. The same flow conditions for the movement in and out of the local and foreign firms are depicted in Equations (3) through (6).

$$\theta_l^{1-\alpha} \eta(u_l + e_{l,F}) = (\delta + \theta_l^{1-\alpha}(1 - \eta))e_{l,L} \quad (3)$$

$$\theta_l^{1-\alpha}(1 - \eta)(u_l + e_{l,L}) = (\delta + \theta_l^{1-\alpha}\eta)e_{l,F} \quad (4)$$

Since we allow for on-the-job-search for both workers in the local and foreign firms, we have equations for local and foreign firms stating that in the steady state the flow of unskilled workers into local firms, $\theta_l^{1-\alpha} \eta(u_l + e_{l,F})$ is equal to the flow of unskilled workers out of local firm, $(\delta + \theta_l^{1-\alpha}(1 - \eta))e_{l,L}$. The flow $\theta_l^{1-\alpha}(1 - \eta)(u_l + e_{l,L})$ of currently employed unskilled workers into the foreign firm equals the flow out of foreign firms, $(\delta + \theta_l^{1-\alpha}\eta)e_{l,F}$. The same is valid for the skilled workers, which are captured in Equations (5) and (6).

$$\theta_s^{1-\alpha} \eta(u_s + e_{s,F}) = (\delta + \theta_s^{1-\alpha}(1 - \eta))e_{s,L} \quad (5)$$

$$\theta_s^{1-\alpha}(1 - \eta)(u_s + e_{s,L}) = (\delta + \theta_s^{1-\alpha}\eta)e_{s,F} \quad (6)$$

2.3. Bargaining and Wages

The Nash wage bargaining model is widely used in matching models of the labor market¹⁸. In the following model, we take the same approach and allow for wages to be determined via the Nash bargaining framework. When a worker and a firm meet, the wage is set in accordance with the Nash bargaining solution; that is, workers explicitly negotiate over wages with their employers. Wage offers are treated as endogenous outcomes of job movement decisions made by the workers and firms as in Mortensen and Pissarides (1999).

In equilibrium, we consider four types of matching: skilled workers in foreign and local

jobs and unskilled workers in local and foreign jobs, respectively. The surplus of the match between firms and workers is shared according to the asymmetric Nash bargaining solution. The surplus of a match, $S(i, j)$, between a job $i(= L, F)$ and a worker of type $j(= \iota, s)$ is given as follows:

$$S(i, j) = W(i, j) + J(i, j) - V(i) - U(j)$$

where $W(i, j)$ denotes the value of employment for a worker of type j in a job of type i , $J(i, j)$ is the value for the firm of filling a job of type i by a worker of type j , $V(i)$ is the value of the vacant job and $U(j)$ denotes the value of unemployment. Matches are consummated whenever the joint surplus $S(i, j)$ is nonnegative, that is:

$$W(i, j) + J(i, j) \geq V(i) + U(j)$$

When a match is formed, the wage w_j^i is given by the Nash bargaining condition:

$$W(i, j) - U(j) = \beta [W(i, j) + J(i, j) - V(i) - U(j)] \quad (7)$$

where $\beta \in (0, 1)$ is the exogenous surplus share of workers. β reflects the bargaining power of workers.

Asset Values

We next develop expressions for the various value functions. In doing this, let r denote the discount rate, which is assumed to be the same for both individuals and firms. We start by discussing the asset values for workers. The asset value of an unskilled unemployed worker, $U(\iota)$, satisfies:

$$r \cdot U(\iota) = b + \theta_\iota^{1-\alpha} \eta (W(L, \iota) - U(\iota)) + \theta_\iota^{1-\alpha} (1 - \eta) (W(F, \iota) - U(\iota)) \quad (8)$$

where the first term on the right hand side is the lump-sum unemployment benefit, b , and the second term refers to the change in the value of unskilled unemployed worker when (s)he becomes employed in the local firm. The third term is the value gained by being employed in the foreign firm.

Similarly, given the assumption that skilled workers accept both types of jobs, local and foreign, the asset value of unemployed skilled workers, $U(s)$, verifies:

$$r \cdot U(s) = b + \theta_s^{1-\alpha} \eta (W(L, s) - U(s)) + \theta_s^{1-\alpha} (1 - \eta) (W(F, s) - U(s)) \quad (9)$$

The second and third terms in Equation (9) denote the change in the value of skilled worker if (s)he is employed in local and foreign firms, respectively.

The value of a j type worker employed in local and foreign firms satisfies the following equations:

$$r \cdot W(L, j) = w_j^L + \delta (U(j) - W(L, j)) + \theta_s^{1-\alpha} (1 - \eta) (W(F, j) - W(L, j)) \quad (10)$$

$$r \cdot W(F, j) = w_j^F + \delta (U(j) - W(F, j)) + \theta_s^{1-\alpha} \eta (W(L, j) - W(F, j)) \quad (11)$$

where the first terms in Equation (10) and (11) are the workers' wage in the local and foreign firms, respectively, and the second terms are the value loss of becoming unemployed, and the third terms are the expected return from being successful in on-the-job search.

The values of local and foreign vacancies are given, respectively, by:

$$\begin{aligned} r \cdot V(L) &= -c_L + \theta_L^{-\alpha} A (J(L, \iota) - V(L)) \\ &+ \theta_s^{-\alpha} B (J(L, s) - V(L)) \end{aligned} \quad (12)$$

$$\begin{aligned} r \cdot V(F) &= -c_F + \theta_L^{-\alpha} C (J(F, \iota) - V(F)) \\ &+ \theta_s^{-\alpha} D (J(F, s) - V(F)) \end{aligned} \quad (13)$$

where $A = \left(\frac{u_L + e_{L,F}}{u_L + e_{L,L} + e_{L,F}} \right)$ stands for the share of unskilled workers applying for a local job in the total job seekers, $B = \left(\frac{u_s + e_{s,F}}{u_s + e_{s,L} + e_{s,F}} \right)$ stands for the share of skilled workers applying for local job in the total job seekers, $C = \left(\frac{u_L + e_{L,L}}{u_L + e_{L,L} + e_{L,F}} \right)$ and $D = \left(\frac{u_s + e_{s,L}}{u_s + e_{s,L} + e_{s,F}} \right)$ are the share of unskilled and skilled workers applying for a foreign job in the total job seekers, respectively. Values, given in Equations (12) and (13), of local and foreign vacancies reflect the assumption that both worker types are capable of performing the local and foreign jobs, but the value of filling the local or a foreign job with a skilled or an unskilled worker differs. A firm who posts a vacancy must pay a recruitment cost of c_i , where $i = L, F$. Given free entry, all profit opportunities from posting vacancies are exploited, hence, in equilibrium, $V(L) = V(F) = 0$.

The values to the firm of filling these vacancies with worker type j verify:

$$\begin{aligned} r \cdot J(L, j) &= y_j^L - w_j^L \\ &+ (\delta + \theta_j^{1-\alpha} (1 - \eta)) (V(L) - J(L, j)) \end{aligned} \quad (14)$$

$$\begin{aligned} r \cdot J(F, j) &= y_j^F - w_j^F \\ &+ (\delta + \theta_j^{1-\alpha} \eta) (V(F) - J(F, j)) \end{aligned} \quad (15)$$

where the terms, $y_j^L - w_j^L$ and $y_j^F - w_j^F$ represent the output of a worker minus the wage paid to the worker. The last term in each equation captures the value loss in case of exogenous job destruction or transferring into local/foreign firms.

Steady State

Next, we concentrate on the steady state equilibrium, which satisfies the following conditions:

1. Match formation is mutually advantageous relative to the alternative of continuing search (Albrecht & Vroman, 2002).
2. The values of maintaining local and foreign vacancies are zero in the steady state.
3. The appropriate steady state labor market flow conditions are satisfied. That is, flow into and out of unemployment, local and foreign firms will be equal, respectively. In addition, the share of local vacancies in total vacancies, η , should fall within the range $[0, 1]$ and labor market tightness should satisfy $\theta_L > 0$, $\theta_s > 0$.

3. EQUILIBRIUM

In order to discuss the implications of increased foreign firm activity on the skill and foreign firm premia we next define the equilibrium of the model¹⁹. The equilibrium is determined by two job creation conditions, plus the steady state conditions equalizing the flows into and out of unemployment, local and foreign firms, for both types of workers. Given exogenous variables that capture the productivity of labor (y_j^i), the bargaining and matching environment (α, β), the job destruction rate (δ) and job creation costs

(c_L, c_F) , the share of unskilled workers in total population (μ) and the interest rate (r) , we will solve for the mass of vacancies v_L and v_F ; wages, i.e. w_L^F , w_s^L and w_s^F , the labor market tightness θ_L and θ_s , and unemployment rate u_L and u_s .

Recall Equations (1) and (2) which capture the flow conditions of workers. We can solve for the unemployment rate of unskilled and skilled workers, u_L and u_s , as a function of labor market tightness (θ_L) and (θ_s) , and the exogenous variables, μ and δ . This yields:

$$u_L = \frac{\delta\mu}{\delta + \theta_L^{1-\alpha}} \quad (16)$$

$$u_s = \frac{\delta(1-\mu)}{\delta + \theta_s^{1-\alpha}} \quad (17)$$

The unemployment rate of skilled workers $\frac{u_s}{1-\mu} = \frac{\delta}{\delta + \theta_s^{1-\alpha}}$ and unskilled workers $\frac{u_L}{\mu} = \frac{\delta}{\delta + \theta_L^{1-\alpha}}$ are derived by re-arranging the terms in Equations (16) and (17). Given μ and δ , the unemployment rate of skilled workers is decreasing in the labor market tightness of the skilled workers θ_s , while the unemployment rate of unskilled workers is decreasing in the labor market tightness of the unskilled workers θ_L .

Since equilibrium requires that $V(L) = 0$ and $(F) = 0$, Equations (12) and (13) could be written as follows:

$$\frac{c_L}{\theta_L^{-\alpha}} = A \left(\frac{y_L^L - w_L^L}{r + \delta + \theta_L^{1-\alpha}(1-\eta)} \right) + \left(\frac{\mu}{1-\mu} \right)^{-\alpha} B \left(\frac{y_s^L - w_s^L}{r + \delta + \theta_s^{1-\alpha}(1-\eta)} \right) \quad (18)$$

$$\frac{c_F}{\theta_L^{-\alpha}} = C \left(\frac{y_L^F - w_L^F}{r + \delta + \theta_L^{1-\alpha}(1-\eta)} \right) + \left(\frac{\mu}{1-\mu} \right)^{-\alpha} D \left(\frac{y_s^F - w_s^F}{r + \delta + \theta_s^{1-\alpha}(1-\eta)} \right) \quad (19)$$

The total amount of vacancies and their allocation across markets are determined by these conditions given above. Actually, Equations (18) and (19) are defined as job creation conditions. These conditions equate the benefit to the firm of filling vacant positions with the suitable candidate and the cost of opening vacancies. In other words, both equations relate the expected cost of a posted vacancy to the expected benefit of a filled job. For instance, if the left hand side of either equation is smaller than the right hand side, then entry to labor market by opening a vacant position is profitable, so that the number of vacancies posted increases. This leads to a rise in the labor market tightness of unskilled and skilled workers until the benefits of job creation are consumed.

3.1. Wages

A Nash bargaining approach to wage setting is used to derive equilibrium wages. Substituting (8), (10), (14) into (7), and imposing the free-entry condition for local vacancies, $V(L) = 0$, we obtain the wage rate from matching of an unskilled worker with a local firm:

$$w_L^L = w_{lb}^L \cdot b + w_{ly}^L \cdot y_L^L \quad (20)$$

In (20), $w_{lb}^L = \frac{(1-\beta)(r + \delta + \theta_L^{1-\alpha}(1-\eta))}{r + \delta + \theta_L^{1-\alpha}(1-\eta + \beta\eta)}$ and $w_{ly}^L = \frac{\beta(r + \delta + \theta_L^{1-\alpha})}{r + \delta + \theta_L^{1-\alpha}(1-\eta + \beta\eta)}$ are the weights attached to the unemployment benefit and labor productivity, respectively. The wage of unskilled workers' employed in the local firm is

determined by the weighted average of the unemployment benefit, b and the output of unskilled worker in the local firm, y_t^L . Particularly, w_t^L depends on the bargaining power of workers, β , share of local vacancies, η and the labor market tightness of the unskilled workers, θ_t .

Substituting (8), (11), (15) into (7), and imposing the free-entry condition for foreign vacancies, $V(F) = 0$, we obtain the wage from a matching of an unskilled worker with a foreign firm:

$$w_t^F = w_{ib}^F \cdot b + w_{iy}^F \cdot y_t^F \quad (21)$$

where $w_{ib}^F = \frac{(1-\beta)(r+\delta+\theta_t^{1-\alpha}\eta)}{r+\delta+\theta_t^{1-\alpha}(\eta+\beta-\beta\eta)}$ and $w_{iy}^F = \frac{\beta(r+\delta+\theta_t^{1-\alpha})}{r+\delta+\theta_t^{1-\alpha}(\eta+\beta-\beta\eta)}$ are the weights

attached to unemployment benefit and labor productivity, respectively. Similarly, the wage of unskilled workers' working in the foreign firm is determined by the weighted average of unemployment benefit, b and the output of unskilled worker in the foreign firm, y_t^F . Specifically, bargaining power of workers, β , the share of local vacancies, η and the labor market tightness of the unskilled workers, θ_t , play a vital role in the determination of unskilled workers' wage in foreign firm.

Substituting (9), (10), (14), and into (7) and imposing the free-entry condition for local vacancies, $(L) = 0$, we obtain the wage of a skilled worker in the local firm, which is given as follows:

$$w_s^L = w_{sb}^L \cdot b + w_{sy}^L \cdot y_s^L \quad (22)$$

where $w_{sb}^L = \frac{(1-\beta)(r+\delta+\theta_s^{1-\alpha}(1-\eta))}{r+\delta+\theta_s^{1-\alpha}(1-\eta+\beta\eta)}$ and $w_{sy}^L = \frac{\beta(r+\delta+\theta_s^{1-\alpha})}{r+\delta+\theta_s^{1-\alpha}(1-\eta+\beta\eta)}$ are the weights

attached to unemployment benefit and labor productivity, respectively. Skilled workers' wage in the local firm mainly depends on the share of local and foreign vacancies, bargaining power of workers and the labor market tightness of the skilled worker.

Substituting (9), (11), (15) into (7), and imposing the free-entry condition for foreign vacancies, $V(F) = 0$, yields a wage of a skilled worker in the foreign firm, which is expressed as follows:

$$w_s^F = w_{sb}^F \cdot b + w_{sy}^F \cdot y_s^F \quad (23)$$

where $w_{sb}^F = \frac{(1-\beta)(r+\delta+\theta_s^{1-\alpha}\eta)}{r+\delta+\theta_s^{1-\alpha}(\eta+\beta-\beta\eta)}$ and $w_{sy}^F = \frac{\beta(r+\delta+\theta_s^{1-\alpha})}{r+\delta+\theta_s^{1-\alpha}(\eta+\beta-\beta\eta)}$ are the weights

attached to the unemployment benefit and labor productivity, respectively. The skilled workers' wage in the foreign firm depends on the share of local vacancies, η , bargaining power of workers, β , unemployment benefit, b and the flow output of skilled worker in foreign firm, y_s^F .

In similar fashion to the wage equations for unskilled workers in both foreign and local firms (depicted in Equations 20 through 22), and skilled workers in local firms, the mass of local and foreign vacancies and the productivity of workers play a vital role in the wage determination for the skilled worker employed in the foreign firm. Actually, wages of both unskilled and skilled workers in the local and foreign firms depend on labor market tightness, share of local (foreign) vacancies and the bargaining power of the workers, but to a different extent. This is due to the fact that the values to the firms of filling those vacancies with the suitable worker depend on the mass of vacancies created by the firms and the productivity of workers, which differs across workers and firms.

Given its central role in wage-determination it is important to identify factors that affect the mass

of vacancies created by both types of firms. The mass of vacancies created by local and foreign firms are determined by the job creation conditions, which are obtained by substituting wage Equations given in (20)–(22) into the equilibrium conditions given in (18)–(19):

$$c_L = (1 - \beta) \left(\frac{u_i + e_{i,F}}{\mu} \right) \theta_i^{-\alpha} \left(\frac{y_i^L - b}{r + \delta + \theta_i^{1-\alpha} (1 - \eta + \beta\eta)} \right) + (1 - \beta) \left(\frac{\theta_s}{\theta_i} \right)^{-\alpha} \left(\frac{u_s + e_{s,F}}{1 - \mu} \right) \left(\frac{y_s^L - b}{r + \delta + \theta_s^{1-\alpha} (1 - \eta + \beta\eta)} \right) \quad (24)$$

$$c_F = (1 - \beta) \left(\frac{u_i + e_{i,L}}{\mu} \right) \theta_i^{-\alpha} \left(\frac{y_i^F - b}{r + \delta + \theta_i^{1-\alpha} (\eta + \beta - \beta\eta)} \right) + (1 - \beta) \left(\frac{\theta_s}{\theta_i} \right)^{-\alpha} \left(\frac{u_s + e_{s,L}}{1 - \mu} \right) \left(\frac{y_s^F - b}{r + \delta + \theta_s^{1-\alpha} (\eta + \beta - \beta\eta)} \right) \quad (25)$$

Job creation conditions for foreign and local firms differ according to *the costs of creating new jobs* and *productivities of the workers* and this gives rise to equilibrium wage differentials in the presence of labor market frictions. Equations (24) and (25) can be rewritten as two equations with two unknowns, v_L , since both θ_j 's and η are a function of v_F and v_L , as are u_j and e_{ij} . Since the extent of foreign firm activity will be measured by the number of vacancies posted by local and foreign firms these two equations are of significance for the remaining discussion. In fact, these two equations suggest that the two most important exogenous factors that determine the extent of job creation by local and foreign firms are the differential costs of doing business across local and foreign firms and the productivity differentials across skills and firms. The remaining exogenous factors that influence the vacancy creation by local and foreign firms include labor market indicators such as the bargaining power of workers,

the skill composition of the population and the job destruction rate, alongside the interest rate.

The following exercise of discussing the link between the number of vacancies posted by local (v_L) and foreign (v_F) firms and absolute and relative wages analytically does not require that the exogenous factor that induces the change in the extent of vacancy posting by either firms be identified. In other words, the analytical discussion has the goal of identifying the qualitative relationship between local and foreign firm activities and the firm and skill wage premia. However, the quantitative results discussed in section 4 require identification of the exogenous factor that alters the extent of local and foreign firm activities in the local economy. The model is quantified under the baseline assumption that it is the changes in the costs of doing business (c_L and/or c_F) that trigger changes in the extent of local and foreign firm activity and in turn changes in wages across skills and firms.

3.2. Discussion of Absolute Wages

The main question of this chapter, the effects of increased foreign presence on relative wages (across skills and firms) is analyzed through the effects of the provision of new job opportunities by both local and foreign firms on absolute wages. To do so we first look into how the relative weights of unemployment benefits and productivity are influenced from the job postings of local firms.

Increased job postings by local firms raises the probability of being matched with a local firm for the unemployed workers and this decreases the weight assigned to the return to unemployment. Thus, the effect of unemployment benefit on local firm wages is likely to become weaker with an increase in v_L . On the other hand, an increase in the mass of local vacancies strengthens the weight assigned to the output produced by the worker in the local firm and this puts an upward pressure on local wages. Given that the

unemployment benefit is less in magnitude than the output from a match between the labor and local firm these weight changes will lead to an increase in the local firm wages of labor. Overall, an increase in the mass of local vacancies (v_L) raises the wages of both skilled and unskilled labor in the local firm (w_t^L and w_s^L). As the value of filling the vacant positions increases, local firms are willing to pay more to fill the position²⁰.

The wage effects of increased local firm job postings are not limited to local firm wages. The new positions offered by local firms decrease the wages in the foreign firm since they improve the outside option value of workers. In other words, the probability of being successful in the on-the-job-search increases for the workers employed in the foreign firm. As foreign firms anticipate that workers will quit their job whenever local firms start to post new vacancies they tend to pay less²¹. Contrary to the case of wages paid by local firms, in this case, the weight of the unemployment benefit increases due to a rise in the local job opportunities. In this context, the effect of unemployment benefit on wages, which is positive, will be more powerful. On the other hand, the weight of the output produced in the foreign firm is likely to decline in response to a rise in the local job opportunities and the extent of the effect of output on foreign wages will become negligible as the number of vacancies offered by local firms increase. Thus, we end up with two opposite effects on the wage of the workers hired by foreign firms. That is, a rise in local job opportunities (v_L) tends to raise the wage of workers in the local firm (w_t^L and w_s^L), while reducing the wage of the workers in the foreign firm (w_t^F and w_s^F).

Increased foreign presence is captured by an increase in the job vacancies posted by foreign firms. The following discussion in fact parallels that regarding the wage effects of increased v_L . The earnings of the workers in the foreign firm (

w_t^F and w_s^F) increase due to the job opportunities created by the foreign firm v_F since they have to pay enough to fill these new vacant positions. As more foreign vacancies are posted, the matching rates of workers increases and the increased availability of foreign jobs decrease the weight assigned to the unemployment benefit. In addition, the weight of the output produced by the worker in the foreign firm increases due to an increase in foreign job creation, and therefore the impact of productivity of workers in a foreign firm on wages will be more powerful. Overall, these two forces suggest that the wages paid to workers in the foreign firms will increase upon increased foreign firm activity.

On the other hand, new job opportunities created by the foreign firm increases the outside option of both unemployed and employed workers. Since local firms anticipate that this increase in the workers' probability of being successful in on-the-job search reduces the match surplus, they tend to pay less for the workers. In this context, the effect of unemployment benefits on local wages will be more powerful upon a rise in the foreign job opportunities. Unemployed workers can accept the local job since they know that they are allowed to change their employee if the foreign firm offers new positions. The weight assigned to output produced from a match between a local firm and a worker also decreases, where the reduction in the effect of productivity on wages is on account of the local firms anticipating that the worker may benefit from the foreign job opportunities. In short, wages of the workers in the local firm decrease while wages of the workers in the foreign firm increase due to the increased foreign firm activity (a higher v_F).

In summary, within this framework wage differentials arise from two main factors: the vacancy creation by local and foreign firms (v_L and v_F) and the productivity differentials across skills and firms. If the mass of local (foreign) vacancies increases the wages of both unskilled and skilled

workers are likely to rise in local (foreign) firms, but new jobs available in foreign (local) firms reduce the wages of both workers in the local (foreign) firm. As in Krause and Lubik (2006), where there are good versus bad jobs with differential costs for firms, fluctuations in vacancies offered by local and foreign firms become a key component in explaining labor market dynamics, particularly, wage differentials. The productivity differentials across firms not only have a direct influence on wages but also indirectly through their impact on the extent of vacancy postings by local and foreign firms. In this regard, our findings parallel those in the literature where a vast number of studies note that higher wages paid by MNEs is largely attributable to productivity differences. While supporting these findings we are able to provide a formal structure that explains this phenomenon where the firm premia arises in part due to the two-sided search, which is a modeling component with empirical support. That is, as the likelihood of finding a foreign job increases (the number of vacancies posted by foreign firms increase), wages paid to the workers in the local firm decreases since the increased likelihood of leaving the firm requires workers to accept a lower wage as a compensating differential for workers.

3.2. Discussion of Relative Wages

The determination of the absolute wages allows for a detailed discussion of the level of and evolution of several wage premia upon increased foreign firm presence. The two economy-wide premia we are interested in are the skill and foreign firm premium defined as $W^{sp} = (w_s / w_l)$ and $W^{fp} = (w_s^F / w_l^L)$, respectively. The economy-wide absolute wages, i.e., $((w_s, w_l), w^F, w^L)$, are calculated as the weighted averages of the individual wages across skills or across firms, where the number of employment is used as the weights. In other words, the overall economy-wide skill

premium is calculated as the ratio of the weighted average of skilled workers' wage in the foreign and local firms to unskilled workers' wage in the local and foreign firms. Similarly, the overall economy-wide firm premium, is calculated as the ratio of the weighted average of wages paid by the foreign firm to the weighted average of wages paid by the local firm. The fact that we are able to solve for the absolute wage levels allows us to further decompose these two economy-wide wage premia and discuss the skill premium paid by local firms (w_s^L / w_l^L) versus that paid by foreign firms (w_s^F / w_l^F) , and the foreign firm premium paid to unskilled workers (w_l^F / w_l^L) versus that paid to skilled workers (w_s^F / w_s^L) . While the literature denotes relative wages as the gap between skilled and unskilled wages by construction the above model allows studying these relative wages both within and between firms and adds value to the literature.

While the above discussion allows for an analytically tractable solution for the absolute wages, the significant nonlinearities evident in equation (20) through (25) emphasizes the need to numerically study the evolution of the six relative wages we note above, upon increased foreign firm presence. To give a preview of the numerical solutions, one can note that this study provides a framework that supports the empirical evidence that the wage effects of increased foreign presence depends on several local conditions, and the firm and skill premia can evolve in different directions and magnitudes across different countries and different sectors. While the analytical solution does not seem to allow for an explicit discussion of the evolution of the relative wages after increased MNE activities, it does allow for the discussion of the level of the foreign firm premium for a given level of foreign firm activity.

As noted in the introduction section, the literature provides mixed evidence regarding the foreign firm premia²². Many studies (Aitken,

et al., 1996; Feenstra & Hanson, 1996; Lipsey & Sjöholm, 2004; Ruane & Uğur, 2002) argue that foreign firms pay more than local firms do due to their productivity advantage. While the productivity differential justifies giving higher wages MNEs also try to minimize labor mobility and attract better workers by giving these higher wages. The foreign firm premia implied by the above model also captures these factors, where the firm premium depends both on the extent of job vacancies posted by local and foreign firms, and the labor productivity. The results further suggest that the skilled (unskilled) workers in the foreign firm are not always paid more than skilled (unskilled) workers in local firm.

Specifically, our results suggest that if the productivity gap is negligible, foreign firms do not necessarily pay more than local firms. In this framework, the wage gap between local and foreign firms also depends on the allocation of vacancies created by the firms, which are implicitly determined by the job creation conditions (captured by the cost differentials between local and foreign firms). This is in line with arguments in the literature that wage differentials between foreign and local firms should be explained by labor market imperfections.

Here we discuss the level of the foreign firm premium for skilled workers, the one for unskilled workers could be easily replicated. Below we are able to show the skilled and unskilled workers in foreign firms may earn more than that of the local firms, that is, $\frac{w_s^F}{w_s^L} > 1$ and $\frac{w_t^F}{w_t^L} > 1$ depending on the labor market frictions, in terms of posted vacancies, and the productivity of the workers in different firms. The below inequality compares the two wages using Equations (23) and (22):

$$\begin{aligned}
 & \frac{(1-\beta)(r+\delta+\theta_s^{1-\alpha}\eta)b+\beta(r+\delta+\theta_s^{1-\alpha})y_s^F}{r+\delta+\theta_s^{1-\alpha}(\eta+\beta-\beta\eta)} \\
 & > \frac{(1-\beta)(r+\delta+\theta_s^{1-\alpha}(1-\eta))b+\beta(r+\delta+\theta_s^{1-\alpha})y_s^L}{r+\delta+\theta_s^{1-\alpha}(1-\eta+\beta\eta)} \Rightarrow \\
 & < \\
 & (1-\beta)\theta_s^{1-\alpha}(2\eta-1)b+(r+\delta+\theta_s^{1-\alpha}(1-\eta+\beta\eta))y_s^F \\
 & > \\
 & -(r+\delta+\theta_s^{1-\alpha}(\eta+\beta-\beta\eta))y_s^L = 0 \\
 & <
 \end{aligned}$$

Although it is difficult to discuss an exact sign for the firm premium, one can argue that for a range of relative productivities and share of vacancies (η) one can show that if the productivity gap between foreign and local firms is sufficiently large, foreign firms end up with higher wages even when labor market imperfections are taken into account.

Since the signs of the derivatives of skill premium and firm premium with respect to local and foreign vacancies are ambiguous, numerical solution is needed to see the effects of increased foreign firm activities on these relative wages. Accordingly, we study the absolute and relative wage effects of increased foreign firm activities in detail by providing a numerical example in the next section. The discussion in section 4 allows further studying the effects of changes in the productivity levels and job creation costs on both absolute and a wide range of relative wages.

4. NUMERICAL EXAMPLE

In this section, we provide a numerical example to illustrate the properties of the model. Our main objective is to study the effects of an increase in the foreign firm presence on a range of wages. However, since the extent of foreign vacancies posted by the foreign firms is endogenously determined by the labor market conditions, it is

necessary to discuss an exogenous factor that will induce a change in this endogenous indicator. The discussion in the model section shows that the extent of job creation is strictly linked to available technologies to the firms and the cost of creating vacant positions. The below exercise puts the cost of job creation at the center of the discussion, where a change in the cost of job creation alters the extent of either the local and/or foreign firm vacancy postings. Once the extent of local and/or foreign firm vacancy creation is determined the effects on absolute and relative wages as well as unemployment are discussed²³.

The parameters are calibrated to match existing studies in the literature. Our goal is to discuss the effects of a change in the extent of foreign firm activity and not to match the results one-to-one with any specific economy. However, to ensure the interpretations are representative of actual experiences we do compare the benchmark solutions to a range of observed outcomes across countries. Accordingly, the matching function is defined as follows: $q_s(\theta_s) = \theta_s^{-\alpha}$ and $q_l(\theta_l) = \theta_l^{-\alpha}$. The baseline parameters are set as follows: $r = 0.05$, $\beta = 0.5$, $\delta = 0.1$, $b = 0.1$, $c_F = 1.6$, $c_L = 0.8$, $\mu = 0.9$, $\alpha = 0.5$, $y_s^F = 2.5$, $y_s^L = 2.0$, $y_l^F = 1.6$, $y_l^L = 1.3$. All these parameter values are reasonable and in line with the other studies including Albrecht and Vroman (2002), Gautier (2002) and Dolado *et al.* (2003). Below, we detail some of these parameters that are specifically important for our discussions.

The share of unskilled labor ranges from 85% in developed countries to 95% in developing countries²⁴. As such in the baseline case the share of unskilled workers in the population, μ , is assumed to compose 90 percent of the total population. The productivity gap between foreign and local firms, $\frac{y_j^F}{y_j^L}$, is assumed to be around 25%.

Previous studies suggest that the productivity gap between foreign and local firms ranges from 10%

to 100% (Kimura & Kiyota, 2007; Conyon, et al., 2002; Davies & Lyons, 1991). This range is further supported in several studies that emphasize that the skilled and unskilled workers in the foreign firm are more productive than the ones in local firm and that skilled workers are more productive than the unskilled workers (Caves, 1996; Dunning, 1993; Fosfuri, et al., 2001). The interest rate is 5 percent and job destruction rate is 0.1.

As was discussed in the introduction, a novel dataset compiled by Morisset and Neso (2002) suggests that foreign firms face much larger costs than local firms do in terms of administrative barriers, ranging from being 12 times larger in India to twice as large in Argentina. Following this evidence it seems reasonable to assume that foreign jobs are more costly to create than local jobs, i.e. $c_F > c_L$. The choice of the absolute levels of these two costs follow a range of models including those by Carlson *et al.* (2006), Faggio and Konings (2001), Hammermesh (1993), Russo *et al.* (2005) and Vanhala (2004). For the benchmark case we set the cost of vacancy creation at 0.8. In line with the evidence discussed above regarding the relative costs for local and foreign firms we set the ratio of the foreign and local firms' job creation costs at 2, i.e. the cost parameters are $c_F = 1.6$ and $c_L = 0.8$ ²⁵. The unemployment benefit level is set at 0.1. Under this choice of parameters, Table 1 presents the baseline solutions.

The solution based on these benchmark parameters suggests that the share of foreign vacancies is 29% of the total vacancies. According to Görg and Strobl (2005) the share of employment by foreign firms in total employment is around 44% in Ireland. The 2007 World Investment Report by UNCTAD also shows that the share of foreign affiliates in total employment can be as high as 47% and 50% as in Singapore and Ireland, respectively but also as low as 3% as in China and Portugal²⁶. The benchmark value of 29% is reflective of a world average according to these

Table 1. Benchmark solution

Benchmark Parameters									
$r = 0.05, \beta = 0.5, \delta = 0.1, b = 0.1, c_F = 1.6, c_L = 0.8$									
$\mu = 0.9, \alpha = 0.5, y_s^F = 2.5, y_s^L = 2.0, y_t^F = 1.6, y_t^L = 1.3$									
Labor Market: Job Opportunities and Unemployment									
v_L		v_F	η			u		u_t	u_s
0.24		0.09	0.71			0.18		0.13	0.05
Wages									
w_t^L	w_t^F	w_s^L	w_s^F	$\frac{w_s^L}{w_t^L}$	$\frac{w_s^F}{w_t^F}$	$\frac{w_t^F}{w_t^L}$	$\frac{w_s^F}{w_s^L}$	W^{sp}	W^{fp}
0.94	0.94	1.51	1.48	1.61	1.56	1.00	0.97	1.59	1.00

quite dispersed values for the share of foreign affiliates in total employment.

We next discuss the wages in the benchmark case. We focus mainly on the relative wages, given the difficulty in matching absolute wages with real data. The economy-wide skill premium is found to be 59%, where the relative wages of skilled to unskilled workers is 1.59. A decomposition of this skill premium across different types of firms suggests that the relative valuation of skills differs between local and foreign firms. The skill premium in the local firm (61%) is higher than the skill premium in the foreign firm (56%). Since the data is sparse on wages across local and foreign firms we are only able to compare the economy-wide skill premia with real data. This figure is in the range of the average of the 50% skill premium reported for developed countries measured from the ratio of nonproduction workers' wages to production workers' wages in Berman *et al.* (1998)²⁷.

The economy-wide foreign firm premium is found to be 0.2%, where the wages paid by the foreign firm relative to those paid by the local firms is 1.002. Barry *et al.* (2005) reports foreign firm premia ranging from zero percent to

82% across different sectors. In fact, the average foreign firm premium for the transportation and equipment, chemicals, wood, paper and printing, rubber plastics, non-metallic minerals and a group of subsectors they classify as other manufacturing is around 5%. This evidence suggests that the low foreign firm premium outcome of the benchmark case is reflective of observed wage premia and is in an acceptable range²⁸. A decomposition of the foreign firm premium across skilled and unskilled workers suggests that the premium is much higher for the unskilled workers than it is for the skilled workers, which could be thought of as being in line with different extents of foreign firm premia across sectors which might differ in their skill intensities²⁹.

Since the benchmark solution of the model is in line with the observed data, in the next section we undertake the exercise of studying the wage effects of increased foreign firm activity in the host economy. As was discussed above, the model requires that changes in an exogenous factor be modeled to induce a change in the extent of foreign firm activity, which in turn would affect the relative wages. Taking cue from the evidence in

the literature that the cost of doing business is an important factor in affecting FDI decisions we take the cost of vacancy creation as this exogenous factor. In section 4.1 the cost of job creation is altered, inducing changes in the mass of vacancies posted by both local and foreign firms and on the labor market outcomes.

4.1. Changes in the Cost Structure

Job creation costs play a vital role in explaining wage dynamics and unemployment. Actually,

governments lower job creation costs to encourage foreign firm entry and to benefit from increased foreign firm activity. However, while in some cases, the government could lower only the costs for the foreign firms, in other cases, the reduction in costs could apply to both the local and foreign firms. We undertake exercises regarding both possibilities. Results presented in Table 2 study the former public policy environment where only the costs incurred by the foreign firm are altered, while results in Tables 3 and 4 show the latter case

Table 2. Decrease in the job creation cost of foreign firm and its labor market implications

Panel A: Vacancies										
$c_L = 0.8$										
	v_L	v_F	η							
$c_F = 3.2$	0.18	0.07	0.95							
$c_F = 2.4$	0.21	0.03	0.86							
$c_F = 1.6$	0.24	0.09	0.71							
$c_F = 0.8$	0.20	0.31	0.39							
$c_F = 0.4$	0.09	0.53	0.15							
Panel B: Wages										
	w_t^L	w_t^F	w_s^L	w_s^F	$\frac{w_s^L}{w_t^L}$	$\frac{w_s^F}{w_t^F}$	$\frac{w_t^F}{w_t^L}$	$\frac{w_s^F}{w_s^L}$	W^{sp}	W^{fp}
$c_F = 3.2$	1.03	0.86	1.77	1.32	1.70	1.53	0.82	0.74	1.70	0.81
$c_F = 2.4$	1.00	0.89	1.67	1.37	1.66	1.54	0.88	0.82	1.65	0.87
$c_F = 1.6$	0.94	0.94	1.51	1.48	1.61	1.56	1.00	0.97	1.59	1.00
$c_F = 0.8$	0.81	1.10	1.26	1.77	1.54	1.60	1.34	1.39	1.58	1.35
$c_F = 0.4$	0.74	1.27	1.12	2.09	1.51	1.65	1.71	1.86	1.63	1.73

where a symmetric cost change occurs for both the local and foreign firms.

Panels A and B in Table 2 show the effects of an exogenous change in the job creation cost of foreign firms on vacancy creation and relative wages, keeping the cost incurred by the local firm constant. The benchmark case assumed that the cost of job creation for the foreign firms was twice as high as that for the local firms. In the following exercise we range this ratio $\frac{c_F}{c_L}$, from 0.5 to 4.

As the job creation cost of foreign firms' falls, the cost gap between local and foreign firms melt down and this stimulates foreign job creation leading to changes in wages paid by the foreign firm and the local firm.

The decrease in the foreign firms' cost of vacancy creation increases the foreign firm presence both in absolute terms (an increase in v_F) and in relative terms (an increase in their share in total job creation captured by a lower η). The increased foreign presence is accompanied by a decrease in the skill premium and an increase in the foreign firm premium. A decomposition of these wage premia shows that the skill premium moves in opposite directions across the local and foreign firms. The larger extent of foreign firm presence seems to synchronously occur with a decrease in the skill premium paid by local firms and an increase in the skill premium paid by the foreign firms. The decrease in the economy-wide skill premium suggests that the local firm's pre-

Table 3. Decrease in the job creation cost of foreign and local firms and its labor market implications, keeping relative costs constant

Panel A: Vacancies										
	v_L	v_F	η							
$c_L = 0.8, c_F = 1.6$	0.24	0.09	0.71							
$c_L = 0.4, c_F = 0.8$	0.50	0.21	0.69							
$c_L = 0.2, c_F = 0.4$	1.02	0.46	0.68							
$c_L = 0.1, c_F = 0.2$	2.06	0.96	0.68							
Panel B: Wages										
	w^L_t	w^F_t	w^L_s	w^F_s	$\frac{w^L_s}{w^L_t}$	$\frac{w^F_s}{w^F_t}$	$\frac{w^F_t}{w^L_t}$	$\frac{w^F_s}{w^L_s}$	W^{sp}	W^{fp}
$c_L = 0.8, c_F = 1.6$	0.94	0.94	1.51	1.48	1.61	1.56	1.01	0.97	1.59	1.00
$c_L = 0.4, c_F = 0.8$	0.95	0.96	1.51	1.49	1.58	1.56	1.00	0.98	1.58	1.00
$c_L = 0.2, c_F = 0.4$	0.96	0.97	1.52	1.51	1.57	1.55	1.00	0.99	1.56	1.00
$c_L = 0.1, c_F = 0.2$	0.97	0.97	1.52	1.51	1.55	1.55	1.99	0.99	1.55	1.00

Table 4. Decrease in the job creation cost of foreign and local firms and its labor market implications, keeping absolute cost difference constant

Panel A: Vacancies										
	v_L	v_F	η							
$c_L = 0.8, c_F = 1.6$	0.24	0.09	0.71							
$c_L = 0.7, c_F = 1.5$	0.28	0.09	0.73							
$c_L = 0.6, c_F = 1.4$	0.32	0.09	0.76							
$c_L = 0.5, c_F = 1.3$	0.37	0.09	0.80							
Panel B: Wages										
	w_t^L	w_t^F	w_s^L	w_s^F	$\frac{w_s^L}{w_t^L}$	$\frac{w_s^F}{w_t^F}$	$\frac{w_t^F}{w_t^L}$	$\frac{w_s^F}{w_s^L}$	W^{sp}	W^{fp}
$c_L = 0.8, c_F = 1.6$	0.94	0.94	1.51	1.48	1.61	1.56	1.01	0.97	1.59	1.00
$c_L = 0.7, c_F = 1.5$	0.95	0.93	1.54	1.46	1.61	1.56	0.98	0.94	1.60	0.97
$c_L = 0.6, c_F = 1.4$	0.97	0.92	1.57	1.44	1.61	1.55	0.95	0.91	1.60	0.94
$c_L = 0.5, c_F = 1.3$	0.99	0.91	1.62	1.42	1.62	1.55	0.91	0.87	1.60	0.91

mium decline dominates the increase of the premium paid by the foreign firms. While the skill premium moves in opposite directions across firms, the foreign firm premium moves in the same direction across different skill levels of labor. The foreign firm premium paid to both the skilled and the unskilled labor increases alongside an increase in the foreign firm presence.

Numerically, a decrease in the foreign job vacancy creation cost relative to the local job vacancy creation cost from 4 to 3, i.e. the cost of foreign firms decreases from 3.2 to 2.4 while that of the local firms remains at 0.8, corresponds to a decrease of the skill premium in the local firm from 1.70 to 1.66 and an increase of the skill premium in the foreign firm from 1.53 to 1.54. This decrease in costs corresponds to a 180% (from 0.05

to 0.14) increase in the foreign presence. While the skill premium within firms move in opposite directions, this increase in foreign presence is associated with a 3.3 percentage point fall in the economy-wide skill premium, from 1.70 to 1.65.

The premium of working for a foreign firm increases for both skilled and unskilled workers, which suggest a rise in the economy-wide foreign firm premium from 0.81 to 0.87 in response to increased foreign firm presence by 180% (from 0.05 to 0.14). This phenomenon could be explained by the fact that as foreign firms offer more vacant positions the outside options of the workers performing local jobs increase, decreasing the value of filling local jobs with a suitable worker, thereby reducing all wages paid by the local firm. In this context, foreign firms pay more to attract skilled

and unskilled workers from both the unemployment pool and the local firms since filling new vacant positions will increase the value of filling a foreign job with suitable workers. Briefly, as the cost differential for creating foreign and local jobs becomes lower, the wage gap between skilled and unskilled workers in the local firm falls and the premium of working in a foreign firm increases.

An interesting result is that regarding the level of the foreign firm premium. Above a certain degree of foreign firm presence, or in other words at levels of foreign vacancy job creation cost that exceeds the local firm vacancy creation costs by more than 100 percent, the foreign firm pays less than the local firm, i.e. the firm premium is less than zero for both skilled and unskilled labor. This is reversed when the foreign job creation cost falls to around double that of the local firm job creation costs and lower. One should keep in mind that the threshold level we find for the relative foreign firm and local firm job creation costs (in this case double) depends on the parameter values. However, regardless of the parameter values the results show support for one of the main propositions of the model discussed above, which suggests that the labor market conditions (costs of vacancy creation and productivity differentials) determine the level of the wage premia³⁰.

To provide a more comparable measure of how changes in the cost of job creation affects the relative wages one can calculate elasticities. Two alternative elasticity measures can be considered. The first measure, which can be labeled as the *cost of job creation elasticity* of the indicators, is the ratio of the percentage point change in the wage premia to the percentage change in the cost of job creation. An alternative measure, which can be labeled as the *foreign firm presence elasticity* of the relevant indicators, is the ratio of the percentage point change in the wage premia to the percentage point change in the share of foreign presence in the market (η).

It is worth noting that the foreign firm presence elasticity of skill premium is lower than the foreign firm presence elasticity of the foreign firm premium at all levels of job creation costs and foreign firm presence. For example, a change in the cost of foreign firms' vacancy creation from 2.4 to 1.6 corresponds to an approximately doubling of the share of foreign vacant positions in total positions (i.e. the increase in $1 - \eta$ from 0.14 to 0.29), a 6 percentage point decrease in the economy-wide skill premium and a 13 percentage point increase in the economy-wide firm premium.

While the above discussion measures foreign presence by the share of foreign firm job offers in total job offers, the qualitative results would prevail even if one were to focus on the absolute number of foreign firm vacancies as the measure of foreign presence. In other words, the above discussion remains intact if one were to look into the corresponding wage premia changes upon an increase in v_F ³¹.

It is somewhat difficult to compare these findings with those in the literature, since earlier studies do not take into account the differential skill premium between local and foreign firms. Modeling this empirically valid feature of local and foreign firms benefiting from skilled and unskilled workers in different extents (both across firms and across skills) allows us to add value to the discussions in the literature. In short, many of the previous studies are based on the premise that an increase in the relative demand for skilled workers by the foreign firms contributes to the increased skill premium in both the investing and the invested economies (see Feenstra & Hanson, 1997, for example). This result is also evident in our findings. However, we are further able to capture the indirect effects of this event on the skill premium offered by the local firms who are competing with the foreign firms in the labor market. Allowing for such interactions and competition between the local and foreign firms in the model allows for a more realistic framework.

Our results suggest that the economy-wide skill premium's evolution depends on the weights attached to the skill premia offered by the local and foreign firms, respectively. Given the cost and productivity parameters used in this exercise, we are able to show that there are cases where the changes in the local firm's skill premium could dominate, while other parameter choices could suggest otherwise. This model also points to the importance of the productivity differences across firms and skills, parallel to the findings of Sayek and Sener (2006) who show the evolution of the skill premium upon entry of the foreign firms depends on the technology gap between local and foreign firms. While we echo the importance of the technology gap in determining the skill premium, we further emphasize the role played by the policy environment, captured by the cost of job creation.

We next study a change in job creation cost with no change in the playing field, i.e. no special treatment to foreign firms. To capture such a change in the policy environment we keep the relative costs constant while changing c_F and c_L . Table 3 shows the results for this exercise. The decrease in the cost of vacancy creation has the same directional effect on the vacancy creation by both the local and foreign firms, where both firms increase the number of job postings. However, the extent of reaction by local and foreign firms differs significantly, where the local firms respond less to the cost decrease than the foreign firms do. As such, the share of foreign firms in the total job market offerings increases as both type of firms face a decrease in their cost of doing business.

As the share of foreign firms decline, the economy-wide skill premium increases and the economy-wide foreign firm premium pretty much remains constant. The decomposition of these premia across firms and across skills, respectively, also follow the above case. An increase in η corresponds to an increase in the skill premium

paid by local firms that outweighs a decrease in the skill premium paid by foreign firms. The foreign firm premium on the other hand decreases for both the skilled and the unskilled labor.

Rather than keeping the relative costs constant we also repeat the exercise where the absolute difference of the vacancy creation costs are kept constant. The basic results of this exercise are presented in Table 4. This exercise suggests that the results could indeed differ when the absolute levels of costs are kept constant but the relative costs are altered. In this case, we find that while the absolute extent of foreign firm vacancies as well as local firm vacancies increase on account of lower costs of job creation the share of foreign firms decreases. This is a major difference from the above two cases, pointing to an important result that the evolution of the skill and foreign firm premium depends on the share of foreign vacancies and not on the absolute level of foreign presence in the economy.

These results point to the importance of studying the effects of foreign firm activity on the local labor market considering the changes in the domestic and foreign firms synchronously. The analysis would be misleading if one only considered the effects of a change in the foreign firm activity without taking into account the interactive decision-making between the local and foreign firms. The above model and the numerical exercise that follows fills this void in the literature which does not take into account this dynamic interaction between the local and foreign firms, with both searching for employees from the same unemployment pool as well as from each other.

If one is to look at the *level* of foreign firm premium under this second case it is evident that similar to the theoretical predictions of the model and the first case discussed in Table 2 foreign firms do not always pay more than the local firms do. The wage difference between local and foreign firms depends on the job opportunities provided by local and foreign firms, which are extensively

determined by the cost of job creation and productivity of workers.

Both the exercise of a change in the cost of only the foreign firms and a change in both firm's costs suggests that an increase in the *share* of foreign firms in the local economy and not the absolute level of foreign firms' activity matters in discussing the skill and foreign firm premium. Regardless of the direction of change in the absolute level of foreign firms (i.e. v_F) an increase in the share of foreign firms (i.e. decrease in η) corresponds to a decrease in the economy-wide skill premium and an increase in the economy-wide foreign firm premium. A decomposition of both premia shows that while the foreign firm premium increases for all types of labor regardless of their skill level, the skill premium increases for the labor employed in foreign firms while it decreases for the labor employed in local firms. Such decomposition once more points to the importance of taking into account the differences and interactions between local and foreign firms and not focusing on the effects of foreign firms in isolation. It is known empirically that the local and foreign firms interact extensively in the labor market, where such labor turnover is actually thought of as a major source of productivity spillovers across firms. Finally, the two cases discussed above point to the important role played by the cost of job creation and productivity differentials in the determination of the *level* of the foreign firm premium.

4.2. Technological Upgrading

Due to the technological upgrading, foreign firms become more productive, increasing the gap between y_s^F and y_s^L . As the output gap between foreign and local firms increases, foreign firms start to offer more positions for workers, hence, the share of vacancies posted by foreign firms increase. While foreign jobs are relatively scarce to start with, in particular, because the cost of

opening foreign vacancies is higher than the cost of opening local vacancies, the supply of foreign jobs exceeds the local jobs due to the technological upgrading. In this context, in response to a rise in the foreign job opportunities, wages of the local firm decrease and wages of the foreign firm increase.

Here, we should also note that an increase in the share of foreign vacancies due to the improvement in foreign firm technology puts an upward pressure on the overall skill premium and firm premium. While an increase in the share of foreign job offerings due to the technological progress (i.e., productivity advantage of the foreign firm rises) lowers the skill premium in the local firm, it raises the skill premium in the foreign firm. Actually, Panel B in the Table 5 reveals that technological progress in the foreign firm increases the premium of working for a foreign firm for both unskilled and skilled workers. This is due to the fact that an increase in the productivity advantage of the foreign firms directly generates an increase in the foreign wages, in particular for the skilled wages, but also its effect on wages becomes more powerful since it increases the jobs created by foreign firms.

The policy implication of the above analysis is that the cost of doing business does have important implications on the labor market outcomes and the role of foreign firms in these outcomes. Furthermore, there are different and important implications of providing special treatment to foreign firms or not. The effects of increased levels of foreign firm activities in the economy differs significantly across the case where only foreign firms' cost of doing business is reduced and the case where both local and foreign firms' cost of doing business is reduced. In addition, the manner in which these costs are reduced, i.e. whether the relative costs or the absolute cost differences are kept constant, matters.

In short, the results from the numerical example support our theoretical predictions that the response of the overall skill and firm premium as well as the response of the absolute wages to

Table 5. Technological upgrading

Panel A: Vacancies										
	v_L	v_F	η							
Baseline technology gap (%10)	0.41	0.29	0.58							
Change from Baseline										
Technology gap %25	0.40	0.33	0.54							
Technology gap %50	0.38	0.43	0.46							
Technology gap %75	0.35	0.51	0.40							
Technology gap %100	0.31	0.61	0.33							
Panel B: Wages										
	w^L_ι	w^F_ι	w^L_s	w^F_s	$\frac{w^L_s}{w^L_\iota}$	$\frac{w^F_s}{w^F_\iota}$	$\frac{w^F_\iota}{w^L_\iota}$	$\frac{w^F_s}{w^L_s}$	W^{sp}	W^{fp}
Baseline technology gap (%10)	0.90	0.95	1.19	1.21	1.32	1.27	1.05	1.01	1.30	1.04
Change from Baseline										
Technology gap %25	0.88	1.03	1.17	1.36	1.32	1.33	1.16	1.17	1.32	1.16
Technology gap %50	0.85	1.27	1.12	1.69	1.31	1.33	1.48	1.50	1.32	1.49
Technology gap %75	0.82	1.52	1.08	2.03	1.31	1.34	1.83	1.87	1.33	1.84
Technology gap %100	0.80	1.86	1.04	2.49	1.30	1.33	2.32	2.37	1.33	2.33

changes in the extent of labor market imperfections and foreign presence depends on several conditions in the market. Briefly, this experiment reveals that, the labor market imperfections and foreigners' share in the labor market have important non-linear effects on the wages of unskilled and skilled workers.

4. CONCLUSION

The increasing and diverse role of multinational enterprises in the labor markets of the host countries raises the important issue of their implications on absolute and relative wages, and unemployment patterns in the local market. Two important relative wages that are expected to be affected

from increased foreign firm activity are the relative wages between skill and unskilled workers (skill premium) and the relative wages between foreign and local firms (foreign firm premium). Allowing for dynamic interactions between local and foreign firms in the labor market, through two-sided search by the current employees and a search for new employees from the same unemployed pool of workers, and incorporating the empirically well-justified differential costs of doing business across the local and foreign firms, as well as productivity differentials between the two types of firms, this chapter is able to discuss the synchronous determination of the skill and the foreign firm premium, and study their evolution upon changes in the market.

The analytical solutions show that an increase in the foreign firm presence, captured by a higher number of vacancy postings by the MNEs, causes an increase in the wages of skilled and unskilled workers employed by the foreign firms, while reducing the wages of both types of workers employed in the local firms. The analytical results further show that when the dynamic interactions between domestic and foreign firms, and cost of doing business and productivity differentials are taken into account the empirically observed fact that the foreign firm premium is not always positive can easily be explained. The highly nonlinear analytical results, however, do not allow for a clear discussion of how several relative wages (both the economy-wide skill and foreign firm premia, and the individual firm or skill premiums) evolve upon increased foreign firm presence. This necessitates solving the model numerically. Numerical solutions confirm the analytical findings, and further show that an increase in the share of foreign firms corresponds to a decrease in the economy-wide skill premium and an increase in the economy-wide foreign firm premium. A detailed analysis of these premium show that while the foreign firm premium increases for all types of labor regardless of their skill level, the skill premium increases for the labor employed in foreign firms while it decreases for the labor employed in local firms. In short, we find that job creation costs as well as the technology gap between local and foreign firms play a very important in the determination of the level of the skill and foreign firm premium, as well as their evolution after increased foreign firm presence.

Finally, our numerical results have an important policy implication regarding those related to the cost of doing business for local and foreign firms. The labor market implications of reducing the costs of doing business for both the local and the foreign firms, versus that of giving special treatment to the foreign firms by reducing only their costs differ.

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ENDNOTES

- ¹ See Caves (1996), Navaratti and Venables (2004), among others for a discussion of the role of MNEs in the global economy and their effects.
- ² Throughout the text, the terms foreign firms and multinationals are used interchangeably.
- ³ See UNCTAD (2007), page 10, for a larger sample of countries. For example, the same ratio is 3% in China, 4% in the US, 7% in Germany, 14% in France, 22% in Hungary, and 47% in Singapore.
- ⁴ See Wood (1994) and Beyer *et al.* (1999) among others for contrasting evidence regarding trade liberalization, and Feenstra and Hanson (1997) and Wu (2001) for evidence regarding outsourcing and FDI.
- ⁵ See Lall (1995), Markusen and Venables (1997), Feenstra and Hanson (1996), Das (2002), Wu (2001), and Sayek and Sener (2006).
- ⁶ The absorptive capacity of the host countries depends on the investment characteristics and local conditions.
- ⁷ The literature uses the term absorptive capacity to capture both the local market conditions such as the availability of skilled labor, the availability of financial market services or extent of international integration, as well as the technology capacity of the local firm, which we label as the investment characteristics above. See Ruane and Uğur (2002) for a discussion of the reasons for why there exists a foreign firm premium. The culprits underlying the foreign firm premium enlisted by Ruane and Uğur (2002) can be included among the absorptive capacities in the language of the below discussion.
- ⁸ The skill premium is measured as the relative wage between male workers with tertiary education and secondary education. The results prevail for other education level comparisons.

- ⁹ Data for Brazil and the Philippines are for the same year, namely 2003.
- ¹⁰ Görg and Strobl's (2005) empirical analysis of employment performances of domestic and foreign plants in Ireland reveals a slightly higher job creation rate of foreign firms leading to a net gain in employment in the foreign firms.
- ¹¹ See evidence reported in Gerschenberg (1987), Bloom (1992), and Pack (1993) on movement of labor from MNEs to local firms in Kenya, South Korea, and Taiwan.
- ¹² The literature on matching models with heterogeneous agents has developed over the last decade, dating back to the influential contributions by Mortensen and Pissarides (1999) and Shimer and Smith (2000).
- ¹³ In this model, the foreign returns to working in the foreign firm are not always higher than the returns to working the local firm, as such foreign workers also try to maximize their returns through on-the-job search efforts. Therefore, we prefer to allow for bi-directional movements between the local and foreign firms.
- ¹⁴ In accord with Girma *et al.* (2001), Wu (2001), and Driffield and Girma (2003), takeovers by MNEs should be expected to have differential effects on employment and wages across different sectors. In a separate work, Saglam (2007) discusses such differential results across sectors using the framework used in this chapter. Due to space limitations, such a comparison is not discussed in this chapter.
- ¹⁵ Carlson *et al.* (2006), Vanhala (2004), and Faggio and Konings (2003) state that assumptions on job creation costs have a crucial role in terms of job reallocation and change the potential policy recommendations of the models.
- ¹⁶ The same discrepancy is evident in Peru where the same ratios are 78 percent and 52 percent for foreign and domestic firms, respectively. For Philippines and Turkey, the same discrepancy is evident, where the same ratios are 48 percent and 14 percent, and 36 percent and 19 percent, respectively.
- ¹⁷ In the numerical simulation exercise, we allow for alternative ordering of these job creation costs. The results are provided in section 4.
- ¹⁸ See Mortensen and Pissarides (1999), Albrecht and Vroman (2002), Gautier (2002), and Dolado *et al.* (2003) among others.
- ¹⁹ The proofs of uniqueness of the equilibrium and the stability of it are available from the authors upon request.
- ²⁰ As the mass of vacancies increase, firms pay more than they need to in order to fill that position. Following the selection theory discussed in Carmichael (1990), this could be due to the fact that a higher wage attracts applicants of higher quality.
- ²¹ In the search literature, wage is a function of the outside option of the workers, where the outside option of the workers depends on the mass of vacancies posted by other firms. Thus, the increased likelihood of leaving the firm requires workers to accept lower wages and since firms anticipate the workers' higher quit rate, reducing the match surplus, they tend to pay less. See Gautier (2002) and Krause and Lubik (2006).
- ²² While studies by Driffield and Grima (2003) and Martins (2004) suggest the foreign firm premium is always greater than zero, i.e. the foreign firms pay more than domestic firms do to workers with similar characteristics, Lipsey and Sjöholm (2004), Almeida (2004), and Barry *et al.* (2005) argue that the premium can be negative in some cases.
- ²³ The framework also allows discussion of the relationship between skill upgrading and technological progress and absolute and relative wages, and unemployment. Due to space limitations, we do not report these exercises in depth.

- ²⁴ These figures are obtained from Barro and Lee (2001), measured as the share of population over 25 years of age that have completed post-secondary schooling and calculated as the weighted average of the countries classified according to the World Bank's development classification. Countries are assigned weights according to their population. These figures also follow Sayek and Sener (2006).
- ²⁵ Dolado *et al.* (2003) set the cost of job creation at 0.5. Since we will assume that foreign firms' cost is twice that of the local firm to avoid having the absolute foreign firm job creation cost as a numeraire we set the benchmark cost at 0.8 rather than 0.5.
- ²⁶ See Table I.5 in page 10 of the report. A much higher η indeed does lead to much higher η values, which could correspond to the cases of China and Portugal.
- ²⁷ The skill premium reported in the study by Berman *et al.* (1998) for developing countries is even larger in magnitude. The numerical exercise in the following analysis suggests that such higher skill premia can be captured with much higher productivity differentials between local and foreign firms, alongside with higher absolute productivity for foreign firms and high costs of vacancy creation for foreign firms. all of these necessary parameter restrictions are indeed realistic changes in modeling developing countries rather than developed ones, lending supporting evidence to our framework.
- ²⁸ This evidence further points to the importance of capturing different sectoral characteristics such as the technology-intensity in the model. In an extension of the basic framework built in this chapter Saglam (2007).
- ²⁹ Barry *et al.* (2005) report a 4% foreign firm premium for the chemicals industry which could be thought of as skilled intensive compared to the textile industry for which they report a 33% foreign firm premium.
- ³⁰ The exercise in this section also allows discussion of the local firm costs exceeding those of the foreign firms. The qualitative results prevail and the quantitative results are provided in the table.
- ³¹ One can also study the unemployment patterns. Due to space limitations, the unemployment figures are not reported. However, in summary the numerical exercise provides evidence of increased foreign firm presence corresponding to a decrease in both skilled and unskilled unemployment rates.